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Changes in behavioral outcomes among children affected by HIV: Results of a randomized controlled trial in China

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Abstract

This study assessed the effects of a multilevel intervention on HIV-affected children's negative behaviors. A total of 536 children aged 6–18 years from 475 HIV-affected families in Anhui, China, participated in the randomized controlled trial. A significant overall intervention effect on reducing negative behaviors was observed at 18-month follow-up, and the effect remained at 24-month follow-up. The intervention showed greater effects for children aged 13–18 years than those aged 6–12 years. Study findings suggest that a multilevel intervention approach could be beneficial for reducing negative behavior in HIV-affected children. Age-specific programs should be considered to maximize the intervention effects.

Keywords

children; family; HIV; intervention; negative behaviors

Introduction

Approximately, 13.4 million children world-wide who are under the age of 18 years have lost one or both parents to AIDS (UNICEF, 2016), and millions more are living with HIV-positive parents or primary caregivers (Betancourt et al., 2014). HIV affects not only people living with HIV (PLH) but also their family members as well as their children (Betancourt et al., 2013; Rotheram-Borus et al., 2005; UNICEF, 2006). The Joint United Nations Programme on HIV/AIDS (UNAIDS) divides "children made vulnerable by AIDS" into two categories: children who have lost either one or both parents to AIDS-related illnesses and children living with one or both HIV-infected parents (vulnerable children; UNAIDS, 2015). HIV-affected children, though not infected with HIV, are made vulnerable by the disease through economic deprivation, disrupted schooling, multiple losses, inadequate care, stigma, and social isolation (Chi and Li, 2013; Ji et al., 2007).

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Children living with HIV-infected parents can be directly affected by their parent's physical illness through disrupted parenting or indirectly affected by increased parental depression or increased conflicts within the family (Murphy et al., 2013). The influence of HIV on children includes changes in family structure, a lack of household support, and adverse livelihood, as well as suboptimal quality and availability of health and education services (Richter et al., 2004). Additionally, HIV-related stigma often extends to a parent's non-infected children (Chi et al., 2014; Wei et al., 2016). Children affected by parental HIV have an increased risk of developmental, social, economic, and psychological problems (Li et al., 2015; UNAIDS, 2004). They are more likely to experience emotional and behavioral issues that lead to depression, low self-esteem, poor performance at school, and delinquent behaviors (Guo et al., 2012; Ji et al., 2012; Tu et al., 2009). Murphy et al. (2012) found that the effects of parental HIV differed across age groups and reported that younger children were more severely impacted by poor maternal health than older children.

Family-based interventions could prove beneficial to improving the well-being of families affected by HIV in resource-limited settings (Betancourt et al., 2014; King et al., 2009; Myer et al., 2014). These interventions have public health potential for promoting mental health in HIV-affected children, as well as addressing their negative behaviors (Rotheram-Borus et al., 2003). A recent systematic review documented that the research on children affected by HIV has mostly been conducted in sub-Saharan Africa (Chi and Li, 2013), and the interventions targeting HIV-affected children have often been individually focused. To date, there is a paucity of research evaluating interventions aimed at improving the psychological well-being of children affected by HIV/AIDS (King et al., 2009), while very few programs have been simultaneously implemented at the individual, family, and community levels (Fawzi et al., 2012).

There are 577,000 people reported living with HIV/AIDS in China (National Health and Family Planning Commission of the People's Republic of China, 2015). Since 2003, the Chinese government has implemented a national HIV policy to provide free antiretroviral drugs for PLH with financial difficulties (Wu et al., 2010). As with the rest of the world, improved treatment strategies have prolonged the lives of parents living with HIV and increased the number of HIV-affected children in China (Hong et al., 2010). China has a strong family-oriented culture, with children being dependent on their parents, and the parent–child relationship is one of the most critical factors contributing to the occurrence of problem behaviors in children (Lee et al., 2007; Xu et al., 2009). This study examines the efficacy of a multilevel intervention conducted at the individual, family, and community levels in reducing negative behaviors of HIV-affected children in rural China. The intervention aims to strengthen positive family relationships between parents and children, as well as to enhance parental support of healthy child development while facing adversity.

Methods

Overview of study design

This study was conducted in Anhui Providence, China, where most existing HIV infections were caused by commercial plasma donations, and many HIV-affected families reside in poor rural areas (Ji et al., 2006; Wu et al., 2001). As the spread of HIV through plasma

donation occurred in the early 1990s, many of the HIV-infected individuals in this region had children between 6 and 18 years of age at the time of the study (between 2011 and 2016; Li et al., 2011). The intervention trial utilized a cluster-randomized controlled design. The study unit is HIV-affected family, including PLH, his or her seronegative family member, and children. The needed sample size (i.e. the total number of HIV-affected families) was based on the outcome measure of PLH. Four counties in Anhui Province were selected because they had large numbers of HIV-affected families, as well as similar demographics and HIV epidemiological characteristics. Within each county, villages with high HIV caseloads were identified and selected, resulting in a total of 32 villages. In each of the four counties, the villages were divided into two groups based on geographic location and number of HIV-affected families in the community. After baseline, the two groups of villages in each county were randomized to either a control condition or an intervention condition to ensure (1) the distance between the intervention and control villages were far enough to avoid potential contamination, and (2) there were a comparable number of HIV-affected families in the two intervention conditions. This randomization resulted in 237 families with 278 children in the intervention condition and 238 families and 258 children in the control condition. Participants completed assessments at baseline, 6-, 12-, 18-, and 24-month follow-ups.

Participants

During the recruitment, PLH were recruited first and were asked to invite one adult family member and children in their family to participate in the study. Our inclusion criteria for PLH were as follows: (1) being 18 years or older, (2) being HIV seropositive, (3) residing in one of the selected villages, and (4) having a child aged between 6 and 18 years in the family. The inclusion criteria for family members were the following: (1) being 18 years or older, (2) being HIV seronegative, (3) living in the same household as the PLH, and (4) knowing the HIV status of the PLH. Child participants were recruited based on the following criteria: (1) being between 6 and 18 years of age, (2) residing in one of the selected villages, and (3) being a member of an HIV-affected family, which means that one or both of their parents were HIV seropositive.

Recruitment procedures

The PLH were approached and recruited from the village clinics where they obtained routine checkups and treatment. Village clinics represent a primary source of care for PLH and residents in the community. Village health workers verbally discussed the study with the potential participants and distributed printed flyers to them. PLH who expressed interest in the study were referred to our trained project recruiters. Those PLH who agreed to participate were asked to invite one adult family member and children in their family to join the study. Informed consents were obtained individually and privately from all participating members prior to the baseline assessment. After obtaining informed consent and permission to contact their children from the PLH and family members, our trained recruiters collaborated with the PLH and family members to meet with the children and inquire about their interest in the study. All children between 6 and 18 years who were living in the same household as the participating PLH were invited to participate.

When recruiting participants, project recruiters used a standardized script to explain study purpose, procedures, potential risks, and benefits. They emphasized the voluntary nature of participation to the prospective participants. Informed consent consisted of adult consent for participants aged 18 years and older, as well as completion of a parent/guardian permission form and a child assent form for children aged between 6 and 17 years. The language used in the child assent form was tailored to be age-appropriate for children in different age groups. Because some PLH may not have disclosed their HIV status to their children, HIV was not mentioned to the children throughout the study, and the study was referred to as a Children's Health Study. The parents or guardians of the children were present during the entire assenting process. All participants provided written informed consent before data collection. A total of 475 families with 536 children participated in the study. The refusal rate was less than 5 percent.

Data collection

Baseline data were collected between October 2011 and March 2013, and the participants were assessed once every 6 months during the 2-year follow-up period. We conducted respective assessments for children aged 6–12 years and for those aged 13–18 years. At baseline and each of the follow-up points, the child participants completed assessments using the computer-assisted personal interview (CAPI) method, in which an interviewer read questions shown on a laptop computer screen to the participating children and input their responses directly into the computer. All assessments were conducted in a private room at a village clinic or a private place according to the participant's preference. Each child assessment lasted approximately 30 minutes. The children received a gift equivalent to 50 yuan (USD 8) for their participation. All procedures and forms were reviewed and approved by the Institutional Review Boards of the participating agencies in China and the United States.

The intervention

A social action theoretical framework guides the development of the intervention program. Social action theory emphasizes social interdependence and its link to personal health, as well as the linkage between social and personal empowerment (Ewart, 1991). Based on the theory, an individual's behavioral changes are a function of the individual's close relationships and the contextual influences (Ewart, 1991). Families could have a critical impact on children affected by HIV in China, including behaviors. The intervention consisted of three modules: (1) a healthy body and healthy mind, (2) positive family interactions, and (3) improved quality of life. The modules were arranged around the theme of TEA, which was also the acronym of our project (together for empowerment activities, TEA). These intervention activities were implemented during a period of 6–8 weeks and were delivered concurrently at three levels. One intervention facilitator team was formed in each county with local health educators. Each intervention facilitator team (2–3 facilitators) was assigned to the same intervention group and delivered the intervention sessions. All facilitators were trained and certified by the research team prior to implementing the intervention:

1. TEA gathering at the individual level, consisting of six group sessions for PLH and family members (with about 10 participants per group), was conducted by trained intervention facilitators to improve their physical and mental health, promote positive coping, and foster their communication and parenting skills. Each TEA gathering session lasted about 90 minutes and included four main components: (1) reframing the issue in addressing challenges faced by HIV-affected families; (2) providing specific information for PLH and family members to conduct home-based family activities with their children; (3) introducing coping skills through role plays, storytelling, and discussions; and (4) addressing environmental barriers for family and children (e.g. financial resources, HIV-related stigma). Children did not directly participate in the TEA gathering sessions.

2. Following each TEA gathering, TEA time activities were conducted at the family level, including home-based family activities with the purpose of promoting positive family interactions. The PLH and family members who participated in the TEA gathering sessions were asked to complete six TEA time activities with their children at home, including (1) a family kitchen cooking recipe that recorded nutritional intake, (2) a painting of a family emotion rainbow, (3) “my family’s multicolored bag” completed by the entire family, (4) “I love my family” memory book, (5) painting the theme of “my dream,” and (6) neighbor tea gathering. These activities were brought home and shared with their children during TEA time. Each family was given a digital camera to document their TEA time activities, and the photos and experiences were shared with the other participants in the following TEA gathering session.

3. TEA garden activities included three types of community events: (1) a community health fair, (2) a community sports event, and (3) a family talent show. Village leaders, along with the help of families participated in the intervention, planned the community events. For example, in the community sports event, all families in the village were invited to be involved in sporting activities, such as a tug-of-war. The children in the study participated in these TEA garden events together with their parents and other children in the community. Community leaders and families participating in the study jointly organized these events, aiming to enhance community and social integration.

Control condition

The control group continued to receive the standard of care following the Chinese government’s policy, including regular follow-up twice a year with a physical checkup and CD4 test. Free antiretroviral therapy was provided for the PLH with CD4 counts less than 500 cells/μL. Additionally, limited program activities were conducted in the control group to tease out the impact of attention experienced by the participants in the intervention condition. Three weekly group sessions were held, focusing on primary care, health education, nutrition, and personal and family hygiene. Children in the control condition did not directly participate in the activities.

Attrition

As shown in Figure 1, the 24-month follow-up rate was 82 percent of the 278 children in the intervention group and 78 percent of the 258 children in the control group. Figure 1 also illustrates the follow-up rates at each assessment for the children and families involved.

Outcome measures

The children were divided into two age groups (6–12 and 13–18 years), based on Kail's definition as well as the cultural context in China (Kail, 2011). The children self-reported their demographic data including gender and age. Even though parental reports of their children's behaviors were often used, the children's self-reports of their negative behaviors constitute an essential source of information (Erhart et al., 2009; Van Der Ende et al., 2012). Therefore, the primary outcome for children included their self-reported negative behaviors. The PLH and family members provided individual demographic information including age, gender, and education level. PLH also reported their family characteristics such as annual family income and family size.

Negative behaviors were measured using the Child Behavior Checklist developed by Achenbach and Ruffle (2000). This instrument was used to assess child and adolescent emotional and behavioral problems, as well as their social competencies (Achenbach and Ruffle, 2000). The checklist was developed to pinpoint specific areas in which the children's behaviors deviated from the norms for age and gender. The selection of this instrument was based on the consultation with the local experts in China to ensure cultural relevance. The provisional version of the questionnaire was pilot tested to assess the feasibility and clarity of the items and response categories (Li et al., 2014). The adapted checklist included three subscales: (1) Withdrawn, (2) Aggressive Behavior, and (3) Delinquent Behavior. Five questions were included in each category. Items in the "Withdrawn" subscale included (1) "you don't get along with other children"; (2) "you like to be alone"; (3) "you refuse to talk"; (4) "you are unhappy, sad, or depressed"; and (5) "you are shy or timid." Questions in the "Aggressive Behavior" subscale included the following: (6) "you argue a lot"; (7) "you are disobedient at home"; (8) "you throw temper tantrums or have a hot temper"; (9) "you get in many fights"; and (10) "you scream a lot." The "Delinquent Behavior" subscale consisted of five items: (11) "you destroy things belonging to your family or other children"; (12) "you hang around with children who get into trouble"; (13) "you lie or cheat"; (14) "you swear or use obscene language"; and (15) "you are disobedient at school."

Children aged 13–18 years rated their problem behaviors using a 4-point Likert scale from (1) "very untrue" to (4) "very true." The overall score was the sum of all the items, with higher scores reflecting a higher level of self-reported negative behaviors ($\alpha = 0.81$). Based on our assessment, the original response categories may be too complex for younger children aged 6–12 years to answer readily due to their limited cognitive abilities. We simplified the four categories to the two age-appropriate answers: (0) "untrue" and (1) "true," and constructed the overall score by summing the 15 items, with a higher score indicating a higher level of negative behaviors ($\alpha = 0.68$). We collapsed responses 1 and 2 (very and fairly untrue) to untrue (=0), and responses 3 and 4 (fairly and very true) to true

(=1) for the older children in order to analyze the scores consistently from both age groups (range of score: 0–15 for both age groups).

Statistical analysis

Descriptive statistics and frequencies of the individual-level (children, PLH, family members) and family-level characteristics at baseline were summarized by intervention condition. Differences between the intervention and control groups in categorical characteristics were compared using chi-square or Fisher's exact tests. For continuous variables, a family-level random-effects model was used to compare children's characteristics, and a *t*-test was used to compare parental or family characteristics.

An intent-to-treat approach was used. We aimed to (1) assess whether the changes in children's negative behaviors differed between the intervention and control conditions at each follow-up assessment, (2) examine whether the effects of the intervention on negative behaviors varied by age group, and (3) investigate whether parent- and family-level characteristics were associated with their children's negative behaviors. To address these questions, we used a single-model approach (with interaction terms), rather than a stratified analysis approach, to simultaneously examine the overall effects of the intervention on negative behaviors and the intervention effects for each age group, as well as to compare the intervention effects between the two age groups. The stratified analysis approach was simpler for making inferences; however, it did not allow us to directly compare the intervention effects on negative behaviors between the two age groups.

We used a single mixed-effects regression model that included both fixed and random effects to assess the effect of the intervention on reducing negative behaviors. This model approach allowed us to formulate the research questions described above into pre-specified comparisons of interest and to exam these pre-specified model comparisons. The fixed effects (covariates) included in this model were (1) the individual-, parental-, and family-level characteristics; (2) the main effects: age group indicator (6–12 and 13–18 years), intervention status (control vs intervention), visit (baseline, 6-, 12-, 18-, and 24-month); and (3) interaction terms: two-way interaction terms (age group-by-visit, intervention-by-visit, age group-by-intervention) and three-way interaction term (age group-by-intervention-by-visit). We also included family-level random effect in the model to account for dependence within families and a compound-symmetry covariance structure to account for repeated observations for each child. SAS PROC MIXED procedure with the *restricted/residual maximum likelihood* (REML) method that accommodates data that are missing at random (Little, 1995; Rubin, 1976) was used to estimate fixed- and random-effects parameters. All statistical analyses were performed using the SAS System version 9.4 (Cary, NC), and graphs were generated using MS Excel.

Results

Demographic characteristics at baseline

The characteristics of the children, PLH, family members, and families are summarized in Table 1. A total of 237 families (278 children and 237 PLH) participated in the intervention

group and 238 families (258 children and 238 PLH) in the control group. No significant differences were observed between the two conditions for child gender, PLH and family member gender and education level, annual family income, or family size. On average, children aged 6–12 years in the intervention condition were younger than those in the control condition (mean: 8.4 vs 8.9, respectively; $p = 0.024$), but the difference was about half a year. The average ages of children aged 13–18 years were comparable between the two conditions (mean: 15.5 vs 15.1). Less than 50 percent of the children aged 6–12 years were male, and over 50 percent of the children aged 13–18 years were male. The average age of the PLH was greater in the intervention group than in the control group (50.4 vs 47.1, respectively; $p < 0.0001$). Of the 238 families in the control group, 50 percent of the PLH were men, 35.7 percent had no education, and about half (47.9%) had 6 or fewer years of education. Of the 237 families in the intervention group, 44.7 percent of the PLH were men, and 41.8 percent reported no education. The average age of the family members in the control and intervention groups was similar (43.3 vs 40.9, respectively), and less than 40 percent of the family members were men (38.2% vs 32.5%, respectively). More than a quarter of the family members had no education (29.8% vs 25.7% for control vs intervention). About half of the families in the control and intervention conditions had an annual family income of more than 20,000 yuan (equivalent to USD 3030: 51.7% for control vs 44.3% for intervention), and over one-third of the families had more than seven members (33.6% vs 37.6%, respectively).

Intervention effect on negative behaviors

Figure 2(A) shows the adjusted reductions in the level of negative behaviors over time among all children. We observed declines in the level of negative behaviors over time for intervention and control. At the 18-month follow-up, the estimated overall mean level of negative behaviors for the intervention children dropped from 2.75 (baseline) to 1.70, whereas that for the control children dropped from 2.68 to 2.20. The mean reductions from baseline were significantly greater in the intervention than in the control groups (1.05 vs 0.48, respectively; $p = 0.028$). The estimated mean level of negative behavior for both groups continued to decline at the 24-month follow-up; however, the intervention group reduced significantly more than the control group (1.44 vs 0.81, $p = 0.018$; as shown in the same figure). We further investigated the patterns of reduction in negative behaviors over time for children aged 13–18 and 6–12 years.

Intervention effect for individual age groups.

Table 2 presents the results from the mixed-effect regression model on negative behaviors. At baseline, no significant difference in negative behaviors between intervention and control at baseline was observed. As illustrated in Figure 2(B), at the 6-month follow-up, we found a significant reduction in negative behaviors reported by children aged 13–18 years in the intervention condition (decreased in adjusted means from 2.58 at baseline to 1.90 at 6 months, $p = 0.02$), which was greater than that in the control condition (changed from 2.51 to 2.49, $p = 0.94$). The adjusted mean of negative behaviors for the intervention children went up slightly at the 12-month follow-up and then continued to decline from the 18-month follow-up to the end of study (solid line). However, the adjusted mean of negative behaviors for children in the control condition stayed at the same as the baseline until the 18-month

follow-up and then decreased at the 24-month follow-up (dash line). Table 2 shows the difference in reductions of negative behaviors between the intervention and control conditions became significant at the 18-month follow-up (0.95 ± 0.44, $p = 0.031$) and remained significant at the 24-month follow-up (0.92 ± 0.45, $p = 0.040$).

Similarly, no significant difference in negative behaviors was found at baseline between intervention and control for children aged 6–12 years. In Figure 2(C), children in both conditions clearly showed significant declines in their negative behaviors over time ($p < 0.0001$). The difference in reductions between the intervention and control groups increased slowly over time and was the largest at the 24-month follow-up; however, the differences in reductions were not statistically significant (difference = 0.33 ± 0.27, $p = 0.23$, Table 2).

Comparing intervention effects between children aged 13–18 and 6–12 years.

At baseline, children aged 6–12 years reported higher mean negative behaviors than children aged 13–18 years in both the intervention (2.83 vs 2.22, respectively) and control (2.76 vs 2.09, respectively) conditions. As shown in Table 2, the intervention effect on negative behaviors at the 24-month follow-up was larger for children aged 13–18 years than children aged 6–12 years (0.92 vs 0.33, respectively). However, the difference in intervention effects between younger and older children was not statistically significant ($p = 0.26$).

Discussion

This article reported on the efficacy of a multilevel intervention in reducing children's negative behaviors. Although the children in this study did not directly participate in the intervention group sessions, intervention effects could possibly be achieved through a combination of factors including improved parental health, enhanced parenting skills, and caregiving capacity among the parents or family members, and mobilized support systems in the community (Li et al., 2015). By participating in the family- and community-level intervention activities, the children might improve their communications with their parents and their awareness of external resources and support; these improvements could also potentially contribute to the intervention effect (Du et al., 2015; King et al., 2009). It should also be noted that the intervention effects were not observed until 18 and 24 months after the intervention, suggesting that using an indirect intervention approach to changing child behavior could be a long and gradual process.

Our study showed that intervention effects were greater for older children than those in the younger group. The difference between the different age groups in the levels of observed intervention effects could be explained by the variation in child development and maturation (Skinner and Zimmer-Gembeck, 2007, 2009). As adolescents become young adults, they are expected to develop psychosocial maturity, accompanied by increased self-control, greater resistance to peer influence, and improved future orientation (Mulvey et al., 2004). Additionally, older children might better understand the concepts embedded in our family-based activities as a result of their improved abstract reasoning skills (Stice et al., 2009). In contrast, younger children had less cognitive and emotional development when the intervention was implemented. Some of the intervention activities, such as working on a family memory book and observing and documenting family members' emotions, might not

be comprehensible to young children, which could have weakened the intervention effects in these children. Future intervention efforts should account for the characteristics of children of various ages and developmental stages (Sherr et al., 2014).

It was observed in the study that, at baseline, children in the younger age group scored higher than older children in negative behaviors. One possible explanation for this result could be that younger children were more vulnerable to the effects of parental HIV than older children. Younger children have been found to be more dependent on caregivers, and thus, they may be more vulnerable to declines in parenting quality and poor parental health (Murphy et al., 2012; Sherr et al., 2014). Additionally, the stress process framework states that the relationship between stressful events and an individual's emotional response is mediated by coping mechanisms and cognitive appraisal (Lazarus and Folkman, 1984). As children's coping capacities increase with age (Zimmer-Gembeck and Skinner, 2010, 2011), older children have a greater variety of coping strategies to reduce the impact of life stressors compared to younger children. For instance, Murphy and Marelich (2008) found that older HIV-affected children seek protective relationships outside of their families when needed, and these relationships could serve as a buffer to mitigate the difficulties caused by parental illness.

The study also showed that, of the HIV-affected children, boys had significantly higher negative behaviors than girls. This finding is consistent with the literature reporting that males are more likely than females to engage in delinquent activities and that this greater likelihood is due to a combination of their stronger associations with risk factors and delinquency (Fagan et al., 2007). Gender is acknowledged to be an important factor in child development that influences behavioral and social-cognitive styles, stress and coping, as well as relationship provisions (Rose and Rudolph, 2006). Future research and programs for HIV-affected children should consider the gender component and the characteristics of various developmental stages of children.

Limitations

Several limitations should be noted when interpreting the findings of this study. First, the study was conducted in a region where most PLH were infected through plasma blood donation. The results may not be generalizable to children of HIV-positive individuals who were infected through other transmission routes. Second, one of the inclusion criteria was that one adult family member had to know of the PLH's HIV status for them to be enrolled in the study. The findings may not be generalized to HIV-affected families in which the PLH's HIV status is not known to any of the family members. Third, no objective measures of negative behavior were used, and the negative behavior measure based on children's self-report may be subject to cognitive capacity and social-desirability bias. Furthermore, since the starting level of negative behaviors reported by children was relatively low, we acknowledged that the absolute declines in the level of negative behaviors might not be substantial. Future research should also consider the impacts of the health status of parents living with HIV/AIDS on their children's negative behaviors.

Conclusion

This study suggested that a multilevel intervention approach to reducing negative behaviors in HIV-affected children could be beneficial. The findings also indicated that age-specific programs are needed to maximize the intervention effects. Adolescents benefited more from the intervention approach than younger children. However, increased attention should be paid to younger children, as they were often more vulnerable to the effects of parental HIV than older children.

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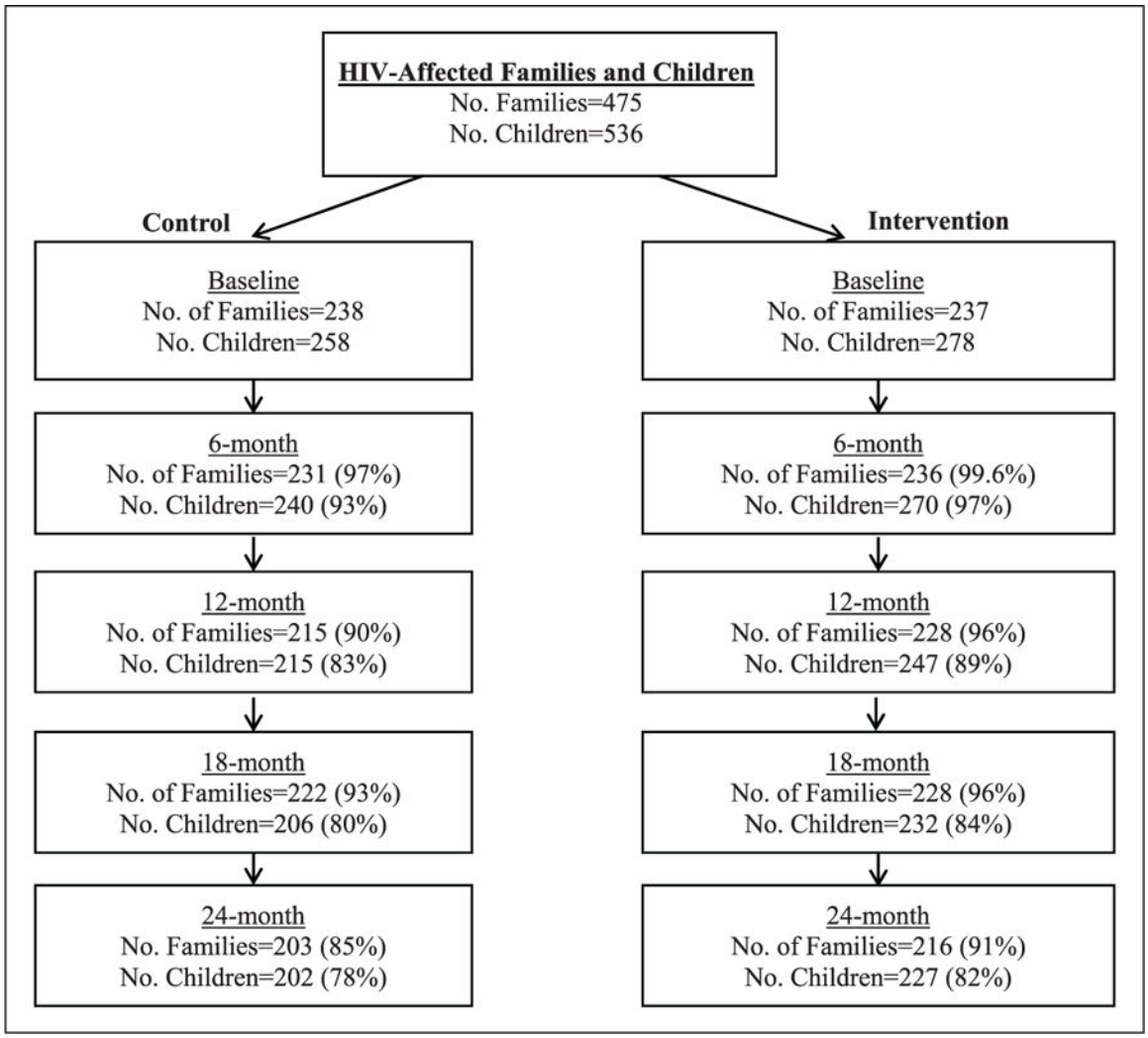

Figure 1.
Flow of study participants.

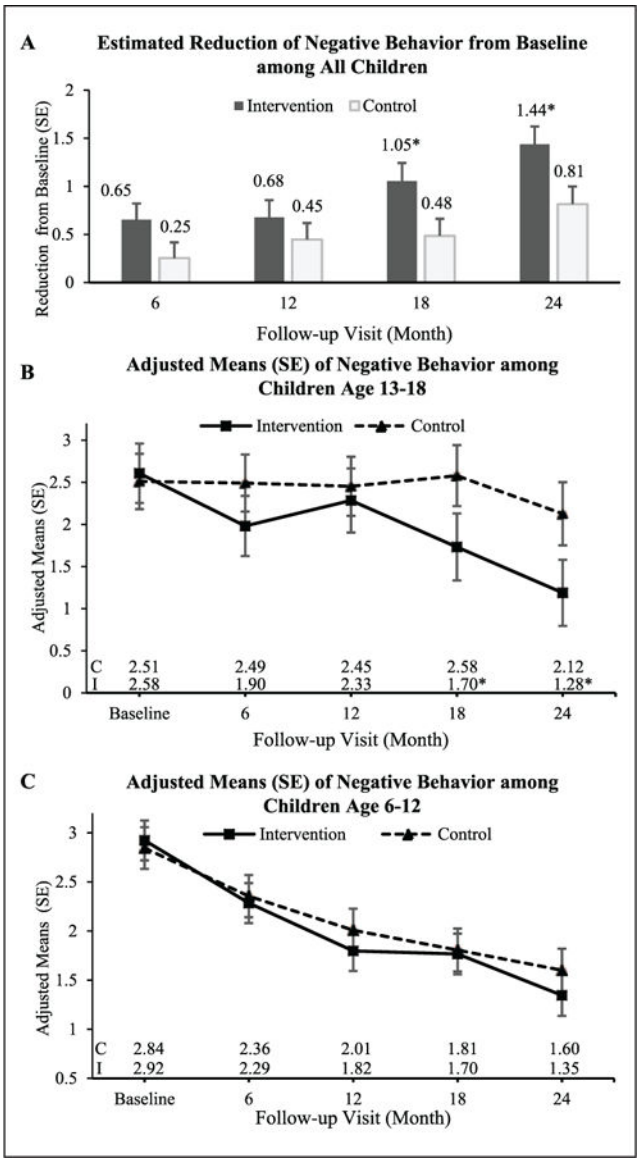

Figure 2.

Reductions in negative behaviors over time for all children (a), adjusted means (with SEs) of negative behaviors over time for older (b) and younger age group (c). *p-value < 0.05.

Table 1.

Sample characteristics and outcome measure at baseline.

	Control	Intervention	*p*
Child characteristics			
Age group: 6–12 years	*N* = 180	*N* = 214	
Age, mean (SD) *	8.86 (2.08)	8.40 (1.81)	0.024
Male, *N* (%)	79 (43.9)	105 (49.1)	0.305
Age group: 13–18 years	*N* = 78	*N* = 64	
Age, mean (SD)	15.1 (1.62)	15.5 (1.44)	0.245
Male, *N* (%)	37 (47.4)	36 (56.3)	0.296
Parental characteristics	*N* = 238	*N* = 237	
PLH characteristics			
Age, mean (SD) **	47.1 (9.42)	50.4 (8.14)	<0.0001
Male, *N* (%)	119 (50.0)	106 (44.7)	0.250
Education, *N* (%)			0.333
None	85 (35.7)	99 (41.8)	
6 years or less	114 (47.9)	107 (45.2)	
7 years or more	39 (16.4)	31 (13.1)	
Adult family member characteristics			
Age, mean (SD)	43.3 (14.1)	40.9 (14.3)	0.072
Male, *N* (%)	91 (38.2)	77 (32.5)	0.190
Education, *N* (%)			0.582
None	71 (29.8)	61 (25.7)	
6 years or less	96 (40.3)	104 (43.9)	
7 years or more	71 (29.8)	72 (30.4)	
Family characteristics			
Household income			0.245
Less than 5000 yuan	6 (2.52)	8 (3.38)	
5001–9999 yuan	24 (10.1)	36 (15.2)	
10,000–19,999 yuan	85 (35.7)	88 (37.1)	
20,000 yuan or more	123 (51.7)	105 (44.3)	

	Control	Intervention	*p*
Family size			0.451
4 or less	60 (25.2)	49 (20.7)	
5–6	98 (41.2)	99 (41.8)	
7 or more	80 (33.6)	89 (37.6)	
Negative behaviors at baseline			
Age 6–12 years, mean (SD)	2.76 (2.17)	2.83 (2.59)	0.774
Age 13–18 years, mean (SD)	2.09 (2.00)	2.22 (2.35)	0.789

SD: standard deviation.

* $p < 0.05$

** $p < 0.001$.

Table 2.

Summary of mixed-effects regression analyses of negative child behaviors.

All children	**Estimate**	**SE**	***p***
Differences of interest (intervention – control)			
Age group: 13–18 years			
Baseline	0.071	0.369	0.847
6 months	−0.661	0.383	0.085
12 months	−0.194	0.415	0.641
18 months	−0.953	0.441	0.031
24 months	−0.919	0.446	0.040
Age group: 6–12 years			
Baseline	0.077	0.231	0.739
6 months	−0.139	0.266	0.601
12 months	−0.268	0.271	0.324
18 months	−0.187	0.273	0.493
24 months	−0.326	0.274	0.233
Individual characteristics			
Male			
Child	0.345	0.137	0.012
PLH	−0.040	0.177	0.820
Adult family member	0.023	0.180	0.900
Education			
PLH (REF = 7 years or more)			
None	−0.170	0.236	0.471
6 years or less	−0.156	0.213	0.464
Adult family member (REF = 7 years or more)			
None	0.343	0.228	0.132
6 years or less	0.319	0.174	0.067
Family characteristics			
Household income (REF = 20,000 yuan or more)			
Less than 5000 yuan	0.806	0.450	0.073

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All children	Estimate	SE	*p*
5001–9999 yuan	−0.122	0.230	0.595
10,000–19,999 yuan	0.208	0.161	0.197
Family size (REF = 7 or more)			
4 or less	−0.084	0.204	0.681
5–6	−0.123	0.161	0.446

SE: standard error; PLH: people living with HIV.

Baseline difference in negative behaviors and difference in the reduction of negative behaviors at each follow-up visit between intervention and control conditions were estimated from the adjusted regression model.

The age group-by-visit interaction was found to be significant ($p = 0.004$), but none of the other two-way interaction terms were significant. The p-value for the three-way interaction age group-by-intervention-by-visit was 0.39.